The Origin of the Universe and the Arrow of Time

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One of the most obvious facts about the universe is that the past is different from the future. The world around us is full of irreversible processes: we can turn an egg into an omelet, but can't turn an omelet into an egg. Physicists have codified this difference into the Second Law of Thermodynamics: the entropy of a closed system always increases with time. But why? The ultimate explanation is to be found in cosmology: special conditions in the early universe are responsible for the arrow of time. I will talk about the nature of time, the origin of entropy, and how what happened before the Big Bang may be responsible for the arrow of time we observe today.

Sean Carroll is a Senior Research Associate in Physics at the California Institute of Technology. He received his Ph.D. in 1993 from Harvard University, and has previously worked as a postdoctoral researcher at the Center for Theoretical Physics at MIT and at the Institute for Theoretical Physics at the University of California, Santa Barbara, as well as on the faculty at the University of Chicago. His research ranges over a number of topics in theoretical physics, focusing on cosmology, field theory, particle physics, and gravitation. Carroll is the author of From Eternity to Here: The Quest for the Ultimate Theory of Time, an upcoming popular-level book on cosmology and the arrow of time. He has also written a graduate textbook, Spacetime and Geometry: An Introduction to General Relativity, and recorded a set of lectures on cosmology for the Teaching Company. Carroll has been awarded fellowships from the Sloan and Packard foundations, as well as the MIT Graduate Student Council Teaching Award and the Villanova University Arts and Sciences Alumni Medallion.

He lives in Los Angeles with his wife, writer Jennifer Ouellette.